CprE 489
Lecture 16

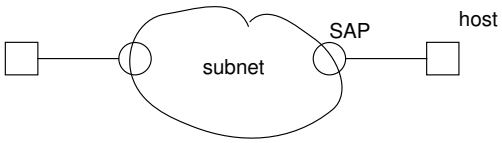
Fall Semester 1997

The Network Layer

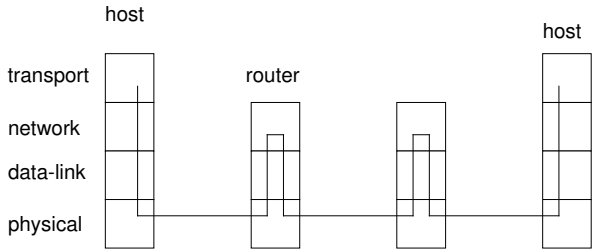
- Physical Layer handles a bit stream which may have errors.
- Data link layer handles the reliable delivery of a bit steam between two nodes by detecting errors, potentially resending lost data, and handling flow control.
- Medium access layer handles coordination of a broadcast channel to achieve point-to-point communication
- Network layer handles coordination among many nodes in a network to achieve point-to-point delivery of data.
  - provide services to the transport layer
  - routing of packets
  - congestion control
  - internetworking

Services Provided to the Transport Layer

- Typically there is a strong separation between the network layer and the transport layer
  - the network layer controls the subnet which is typically owned by a "service provider" while the transport layer is owned by the "customer."
- Main goals of the service
  - The service provided is host-to-host so that the transport layer need not know what the underlying network looks like or what the technology is.
  - Service access points (SAPs) should be addressed uniformly over all hosts that may ever want to talk to each other.



Relationship Between the Layers



Types of Services Provided

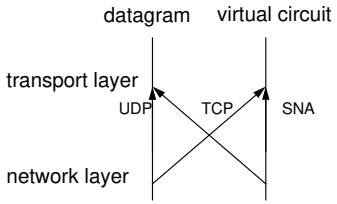
- Virtual Circuit - similar to telephone service
  - a connection is requested from one host to another
  - the connection is set up or refused
  - packets flow along the connection - FIFO order of delivery
  - connection is disconnected
- Datagram - similar to the postal system
  - connectionless service
  - each packet is individually addressed from one host to another
  - datagrams may not be FIFO
- The service provided can be negotiated between the transport layer and the network layer.
  - bandwidth and delay of virtual circuit
  - priority datagrams

Virtual Circuits - Internal vs. External

- Internal virtual ciruit is one implemented at the network layer
  - network layer provides a session service to the transport layer
  - transport layer is assured FIFO service and can negotiate service guarantees with the network layer
  - tyically uses fixed routes and preallocated buffer space
  - examples: ATM, SNA
- External virtual circuit is one implemented at the transport layer using a datagram network service
  - transport layer must provide its own session service
  - transport layer must provide error control, flow control, and reorder out of order packets
  - service guarantees difficult
  - example: TCP

Internal vs. External Service

	Datagram	Virtural Circuit
Network Layer	IP	ATM, SNA
Transport Layer	UDP	TCP

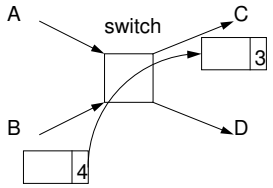


- IP = Internet Protocol
- ATM = Asynchronous Transfer Mode
- SNA = Systems Network Architecture
- UDP = User Datagram Protocol
- TCP = Transmission Control Protocol

Network Layer Virtual Circuit

- When a virtual circuit is requested a specific route from source to destination must be found.
- Each switch has a number of available logical circuits to other adjacent switches. Virtural circuits are multiplexed by the switch.

Virtual Circuit Table

In	Circuit No.	Out	Circuit No
A	2	C	1
B	4	C	3
A	3	D	4
B	1	D	2
B	5	C	5

Available lists:
C: 2,4 D: 1,3,5